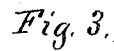
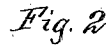


Patented Oct. 21, 1879.



*Inventor:*  
Hiram Berdan  
By his Attorneys  
Brown & Brown

# UNITED STATES PATENT OFFICE.

HIRAM BERDAN, OF NEW YORK, N. Y.

## IMPROVEMENT IN TIME AND DISTANCE FUSES FOR SHELLS.

Specification forming part of Letters Patent No. **220,792**, dated October 21, 1879; application filed August 5, 1879.

*To all whom it may concern:*

Be it known that I, HIRAM BERDAN, of the city of New York, in the county and State of New York, have invented certain new and useful Improvements in Shrapnel and Distance Fuses, of which the following is a specification.

The object of the invention is to produce a fuse to burst shrapnel with perfect regularity at all desired distances within the range of the cannon, without reference to the difference of the velocity of the shell during its flight, to the variations of the weather, the charge of powder, the difference of the burning qualities of the powder, as well as without reference to the time it has been stored in magazine, as it is well known that the ordinary time-fuse is defective on all these points, for the reasons, first, that the system at present in use is a time-fuse and not a distance-fuse; second, that the velocity of the projectile is not the same at any two points; third, it is believed to be impossible to make a mixture of fuse-powder and press it with sufficient uniformity to make the fuses burn with the required regularity; fourth, that the fuse-powder deteriorates by storage.

The great variations in the distance of the bursting of shrapnel will be readily understood when one considers the immense velocity of the projectile—about five hundred meters per second; also the great difference of velocity at different distances.

The nature of the invention is a mechanical fuse, so constructed as to burst the shrapnel when the latter has reached the distance to which the fuse is set without reference to the velocity of the projectile or any cause whatever that could affect the burning of the ordinary fuse; therefore it may be called a "distance-fuse," in contradistinction to the "time-fuse," and to so construct the shrapnel as to produce a perfect system of lubricating the gun.

This fuse is so constructed as to utilize the rotary motion of the projectile operating on a wheel attached to a weight supported by a spindle in the axis of the projectile.

In the accompanying drawings, Figure 1 designates a longitudinal section of a portion of a shell embodying my invention. Fig. 2 is

a side view of my improved mechanism, the head of the shell being removed; and Fig. 3 is a plan thereof, the head being removed.

Similar letters of reference designate corresponding parts in all the figures.

The body part *a* of the shell, of cast-iron, contains the powder-tube and bullets set in sulphur in the ordinary way. The diaphragm *c*, made of bronze, is connected to such body part by three screws, *s*, working in slots, allowing a slight movement in firing, and is screwed onto the cast-iron conical head *b* of the shell. It is provided with a step for one of the ends of the spindle *f*, hereinafter mentioned. The said diaphragm bears at its lower part the fulminate *q*, with powder beneath.

The lubricating recess *d*, formed between the diaphragm and the body-part of the shell, is filled with a mixture of tallow and wax, or other lubricating material, which serves a double purpose. The recess *d* is so formed that in firing, the body-part of the shell being forced forward, the lubricating material first serves as a cushion to deaden the shock produced by the gases of the powder, and then is pressed out with great velocity against the rifling of the gun.

The outer side of the recess *d* is made inclined inward, and the end of the body of the shell is correspondingly chamfered or tapered; hence, as the shell moves forward, it forces out the lubricating material under a constantly-increasing resistance as the two inclined parts approach each other.

It will be seen that this lubricating material is entirely protected during transport and handling, and, all the material being thrown against the rifling forward of the belt that is to give the spiral motion, there is no waste, as in all other systems.

A spindle, *f*, the ends of which rest in the steps *g g*, has a weight, *e*, attached firmly to it, so that, in firing, the weight does not revolve with the projectile, and remains relatively stationary in a vertical position.

The driving endless screw *h* revolves with the diaphragm and projectile, and thereby rotates the driving-wheel *i*, supported by the weight, and having an endless screw cut upon it, which screw actuates the fifty-teeth wheel *k*, loose on the spindle *f*.

That arrangement of two endless screws with one intermediate wheel enables, by adopting proper proportions for the several parts, to get one revolution of the wheel *k* for any given number of revolutions of the projectile—as, for instance, for one thousand two hundred and fifty revolutions as assumed in the drawings. The wheel *k* carries with it an index-disk, *l*, graduated to any distance required, a spring-washer, *n*, and nut *m*, holding it thereto with the required firmness, but enabling the disk to be set without moving the wheel. An index, *z*, serves to exactly determine the position of the disk. Said disk *l* is provided with an opening, through which a firing-bolt, *o*, is forced by a spiral spring, *p*, when arrived at the distance to which it has been set, thus bringing the rear end of the bolt in contact with the fulminate *q* in the diaphragm *c*. The firing-bolt being suspended, and the diaphragm rapidly rotating, the fulminate is ignited. The firing-bolt is guided in its motion by a fixed pin, *t*, engaged in a groove.

The above-described distance-fuse works as follows: In firing, a rotating motion is imparted by the rifling of the gun to the shell, as also to the diaphragm *c* and driving-screw *h*. The weight *e*, on the contrary, in consequence of its inertia and of the small friction of its spindle in the steps, remains stationary with the driving-wheel *i*. The endless screw cut upon the latter actuates the tooth-wheel *k* and the index-disk *l*, attached thereto, and which, having been set to the required distance, brings at the proper time its opening opposite the rear end of the firing-bolt, which is forced downward through said opening, and explodes the fulminate, and consequently fires the powder in the tube.

Many modifications and combinations may be made of this fuse without departing in the least from the nature of the invention, such as a combination of a percussion-fuse with the distance-fuse, to assist in determining the range, or of placing the ends of the spindle in steps formed in plungers held up to their re-

spective positions by springs for special calibers, &c.; but

What I claim as my invention, and desire to secure by these Letters Patent, is as follows:

1. The combination, in a shot or shell, of a pendulous weight hanging loosely upon a centrally-arranged spindle within the same, a firing-bolt secured to said weight and having a longitudinal movement, a spring for actuating said firing-bolt, a stop for holding said bolt against the resistance of the compressed spring, and mechanism actuated by the rotation of the shot or shell for releasing said firing-bolt, substantially as specified.

2. The combination, in a shot or shell, of a pendulous weight hanging loosely upon a centrally-arranged spindle within the shot or shell, a firing-bolt secured to said weight and actuated by a spring, a dial for holding said firing-bolt against the compressed spring, and provided with an opening through which said bolt may pass, and mechanism for rotating said dial actuated by the rotary movement of said shot or shell, substantially as specified.

3. The combination, in a shot or shell, of the weight *e*, hanging upon the spindle *f*, the firing-bolt *o*, and spring *p*, for actuating the same, the dial *l*, provided with an opening through which said bolt may pass, the endless driving-screw *h*, and the wheels *i* *k*, for imparting motion from said endless driving-screw to said dial, substantially as specified.

4. The combination, in a shot or shell, of the head *b*, having upon its under side the annular recess *d*, the outer wall of which is tapered inward, and the body *a*, having a longitudinal movement relatively to said head, and having its end slightly chamfered or tapered correspondingly to the inclined side of the recess, substantially as and for the purpose specified.

H. BERDAN.

Witnesses:

F. MAITLAND RANSOME,  
W. PAINE.